

~~What is Claimed is:~~

~~1. A method for forming a mask assembly for use in lithography comprising the steps of:~~

~~5 forming a support structure that comprises a substrate that includes a plurality of windows filled with a temporary fill;~~

~~forming over the filled-windowed substrate a mask; and~~

~~removing the temporary fill.~~

~~10 2. The method of claim 1 wherein the mask comprises a membrane layer covered by a mask layer.~~

~~3. The method of claim 1 wherein the mask is a stencil mask.~~

~~15 4. A method for forming a mask assembly for use in lithography comprising the steps of:~~

~~forming a support structure that comprises a substrate that includes a plurality of windows filled with a temporary fill;~~

~~20 forming over the filled-windowed substrate a membrane layer for supporting the mask layer; and~~

~~forming a mask layer over the membrane layer;~~

~~and~~

~~removing the temporary fill.~~

~~25 5. The method of claim 4 in which the support structure is formed by the steps of:~~

~~forming in a substrate a first set of spaced apart windows;~~

~~filling the first set of windows with a temporary fill;~~

~~30 forming in the substrate a second set of windows located in portions of the substrate between the first set of filled windows; and~~

~~filling the second set of windows with a temporary fill.~~

~~35 6. The method of claim 5 in which the first partial set of windows is approximately one half of the total number of windows to be formed and the second set includes the remaining windows to be filled.~~

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7. The method of claim 6 in which the windows are in a two dimensional array of rows and columns and in which the first set consists of alternate windows in each row and column.

5                   8. A method of forming a mask assembly comprising  
the steps of:

forming in a substrate a support structure, which includes major and minor struts that define an array of windows in a two-dimensional array of rows and columns, by successive rounds of cutting in the substrate a fraction of the total window area to be formed;

filling such fraction of windows with temporary fill before the succeeding round of cutting and filling until all the window areas are cut and filled;

forming a membrane layer over a top surface of the support structure;

forming a mask layer over the membrane layer;

and

removing the fill from the windows.

9. The method of claim 8 in which the first round of cutting involves cutting approximately one half of the windows to be cut and a second round involves the remainder.

10. The method of claim 9 in which the first round of cutting is of alternate windows in each row and column.

11. The method of claim 4 in which the support structure is formed by the steps of:

placing in a mold which is shaped to facilitate the formation of a support structure a plurality of parallel minor struts; and

forming in the mold a support structure that comprises a frame and plurality of major struts that are orthogonal and attached to the minor struts with the major and minor struts defining a plurality of windows arranged in a two dimensional array of rows and columns.

12. The method of claim 11 further comprising the step of removing the support structure from the mold.

13. The method of claim 4 in which the forming over the filled-windowed substrate of the membrane and mask layers includes the steps of:

5 forming over a surface of a second substrate in turn a layer suitable for the mask and a layer suitable for the membrane;

bonding the membrane layer of the second substrate to the first-mentioned substrate in a manner to expose the second substrate, and

10 removing selectively the second substrate to expose the mask layer.

14. The method of claim 13 in which the second substrate is first implanted with ions to create in its interior an ion-implanted region and the second substrate is removed in part by cleaving along the ion-implanted region.

15. The method of claim 7 in which the forming over the filled-windowed substrate includes the steps of:

20 forming over a second substrate a mask layer and a membrane layer;

bonding the membrane layer to the filled-windowed substrate and leaving exposed the second substrate;

25 selectively removing the second substrate to expose the mask layer.

16. A method of forming a mask assembly for use in electron beam lithography comprising the steps of:

30 forming in a substrate a first set of spaced-apart windows;

filling the windows with a temporary fill;

35 forming in the substrate a second set of windows in the spaces between the first set of windows for forming with the first set a two-dimensional array of windows arranged in row and columns;

filling the second set of windows with a temporary fill;

depositing over the filled-windowed substrate a layer suitable for supporting a mask;

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depositing over the last-mentioned layer a layer suitable for providing a mask; patterning the last-mentioned layer to form a mask, and

5 removing the temporary fill from the windows,  
whereby the mask layer is free of underlying substrate.

17. The method of claim 16 in which the substrate  
is chosen from the group consisting of aluminum oxide and  
silicon carbide, the membrane is chosen from the group  
consisting of silicon, silicon nitride, silicon carbide,  
diamond, and aluminum oxide, and the mask is chosen from  
the group consisting of tungsten and tantalum silicon  
nitride.

18. The method of claim 16 in which the major  
surfaces of the filled-windowed substrate are planarized  
and made parallel before the deposition of the membrane  
layer.

25 elongated strips of a flexible material;

20. A method for forming a mask assembly comprising  
the steps of:

30 forming by use of a mold a support structure  
that defines an array of windows arranged in rows and  
columns;

35 filling the openings with a temporary fill;  
forming over the support structure a membrane  
layer;  
35 forming over the membrane layer a patterned  
mask; and  
removing the temporary fill.

21. The method of claim 20 wherein the support structure comprises major struts which are orthogonal to

minor struts with the minor struts being placed in the mold prior to forming of the major struts and a frame which supports the major and minor struts.

5 22. A method of forming a mask support structure comprising the steps of:

forming in a substrate a first set of spaced apart windows;

10 filling the first set of windows with a temporary fill;

15 forming in the substrate a second set of windows located in portions of the substrate between the first set of filled windows; and

20 filling the second set of windows with a temporary fill.

25 23. A method of forming a mask support structure comprising the steps of:

30 placing in a mold which is shaped to facilitate the formation of a support structure a plurality of parallel minor struts;

35 forming in the mold a mask support structure that comprises a frame and plurality of major struts that are orthogonal and attached to the minor struts with the major and minor struts defining a plurality of windows arranged in a two dimensional array of rows and columns;

40 and

45 filling the windows with a temporary fill.

50 24. The mask assembly formed by the method of claim

55 1.

60 25. The mask assembly formed by the method of claim

65 2.

70 26. The mask assembly formed by the method of claim

75 3.

80 27. The mask assembly formed by the method of claim

85 4.

90 28. The mask assembly formed by the method of claim

95 5.

200 6. The mask assembly formed by the method of claim

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7. 30. The mask assembly formed by the method of claim

8. 31. The mask assembly formed by the method of claim

5 32. The mask assembly formed by the method of claim

9. 33. The mask assembly formed by the method of claim

10. 34. The mask assembly formed by the method of claim

10 11. 35. The mask assembly formed by the method of claim

12. 36. The mask assembly formed by the method of claim

13. 37. The mask assembly formed by the method of claim

14. 38. The mask assembly formed by the method of claim

15. 39. The mask assembly formed by the method of claim

16. 40. The mask assembly formed by the method of claim

17. 41. The mask assembly formed by the method of claim

18. 42. The mask assembly formed by the method of claim

25 19. 43. The mask assembly formed by the method of claim

20. 44. The mask assembly formed by the method of claim

30 21. 45. The mask support structure formed by the method  
of claim 22.

46. The mask support structure formed by the method  
of claim 23.